The Business Case
Distributed Energy Resources

Clean Distributed Generation:

Technology Overview &

Local Siting, Permitting and Code Issues

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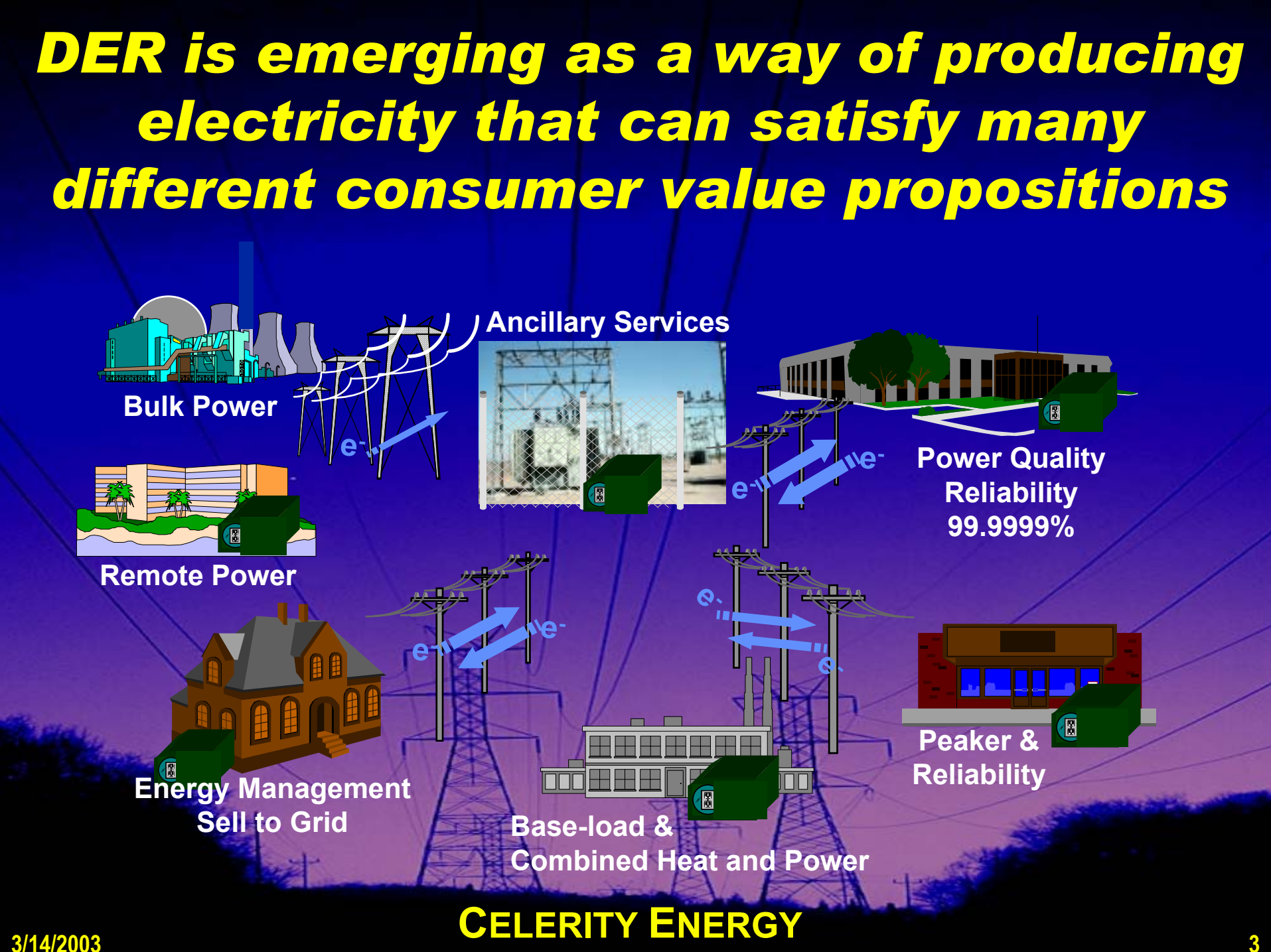
Dave Hoffman
dhoffman@celerityenergy.com

CELERITY ENERGY

Introduction

- Celerity Energy is a new type of Energy Management Company - **EMCO**
- The Celerity Energy management team has over 200 years experience with gas & electric Utilities companies
- Celerity Energy is in business to create energy solutions with Distributed Energy Resources - **DER**. Those solutions are intended to be technology and vendor neutral
- These solutions will optimize utilization of assets in the supplier chain & energy per unit of work for end-users
- What does that mean? We look for opportunities to get value from DER both inside and outside of the meter boundary

DER is emerging as a way of producing electricity that can satisfy many different consumer value propositions



On Site Locational Value

APPLICATIONS

- Prime Power
- Small Power Plants
- Standby/Emergency
- Load Management
- No-Break
- Fuel Arbitrage
- Load shift
- Direct power

LOCATIONAL VALUES

- Heat
- PQ (Power Quality)
- Capacitance
- Load & power factor
- Harmonics
- Ancillary Services
- Air Quality
- Avoided cost

… all focused on optimizing the energy component of goods and services

The Ultimate Networking of Distributed Resources

The Computer Analogy to Networked Energy Resources

Computer	DER
Stand-alone the original computer on the desktop	**Standby** traditional standby role no grid interaction
LAN interacting & sharing resources at a site	**Paralleled** paralleling allows for sharing with feeder
WAN Internet - public and private and all implications	**Aggregated** a fully capable asset supporting both grid and site

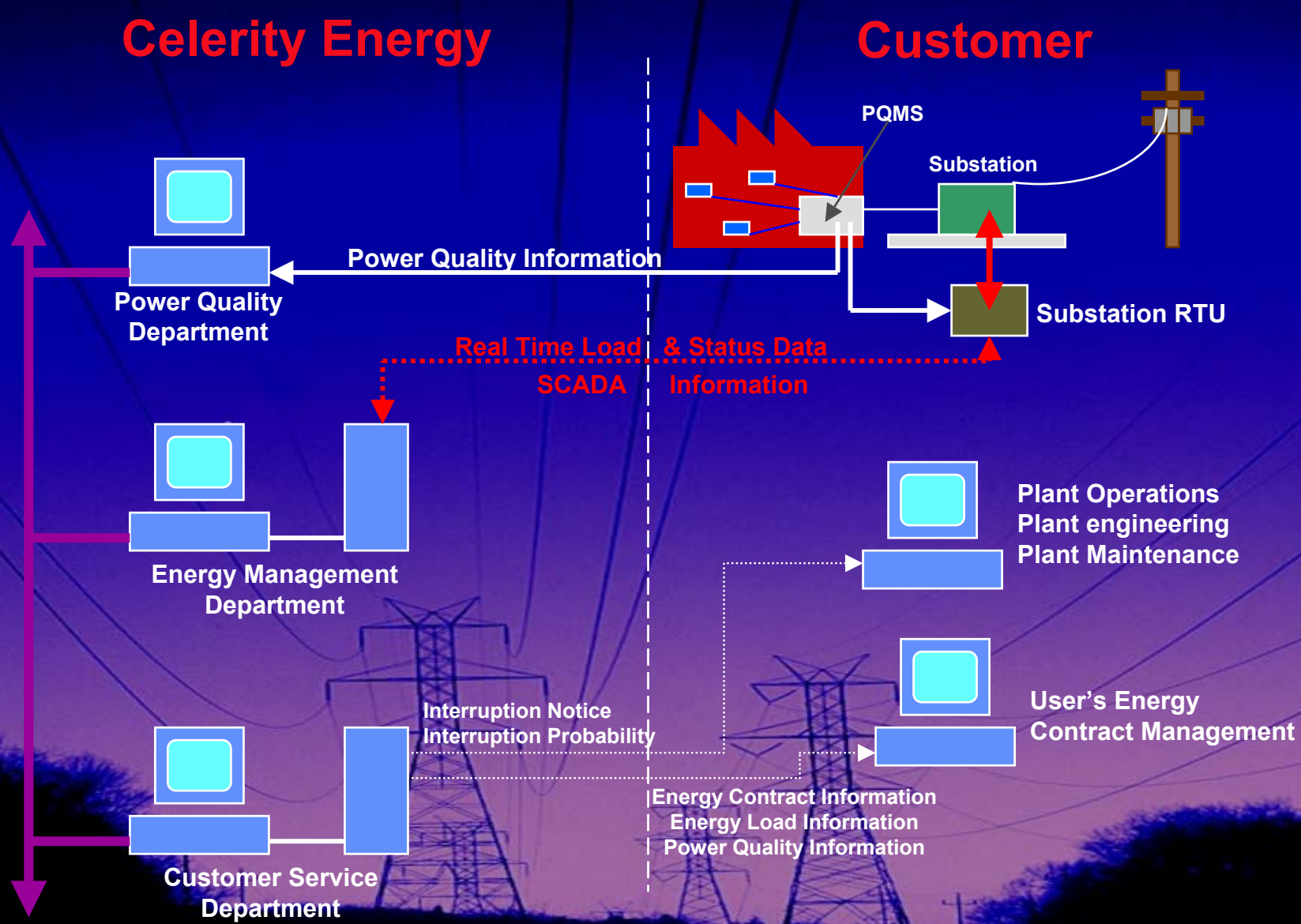
To understand the Networking opportunity, the developer must first understand energy's total cost to the customer & supplier

- fuel
- generation
- environmental
- transmission
- distribution
- capacity
- quality of supply
- kVARS
- loss

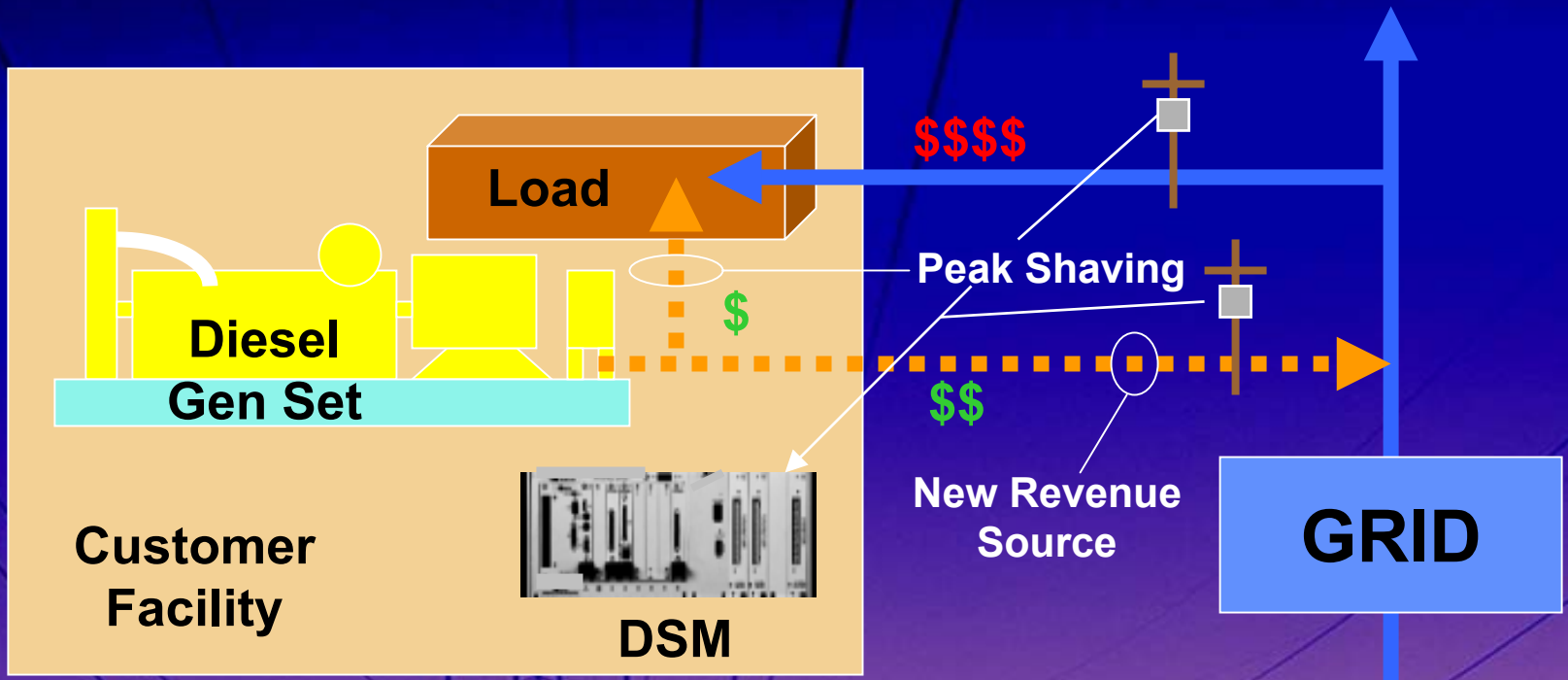
---------- Service Entrance

- O & M - physical plant
- DSM
- risk
- DER

Meaningful Power Monitoring



Peak Shaving & Networked DG



- ✓ Lowering Energy Cost
- ✓ Improved ROI

Off Site Values

APPLICATIONS

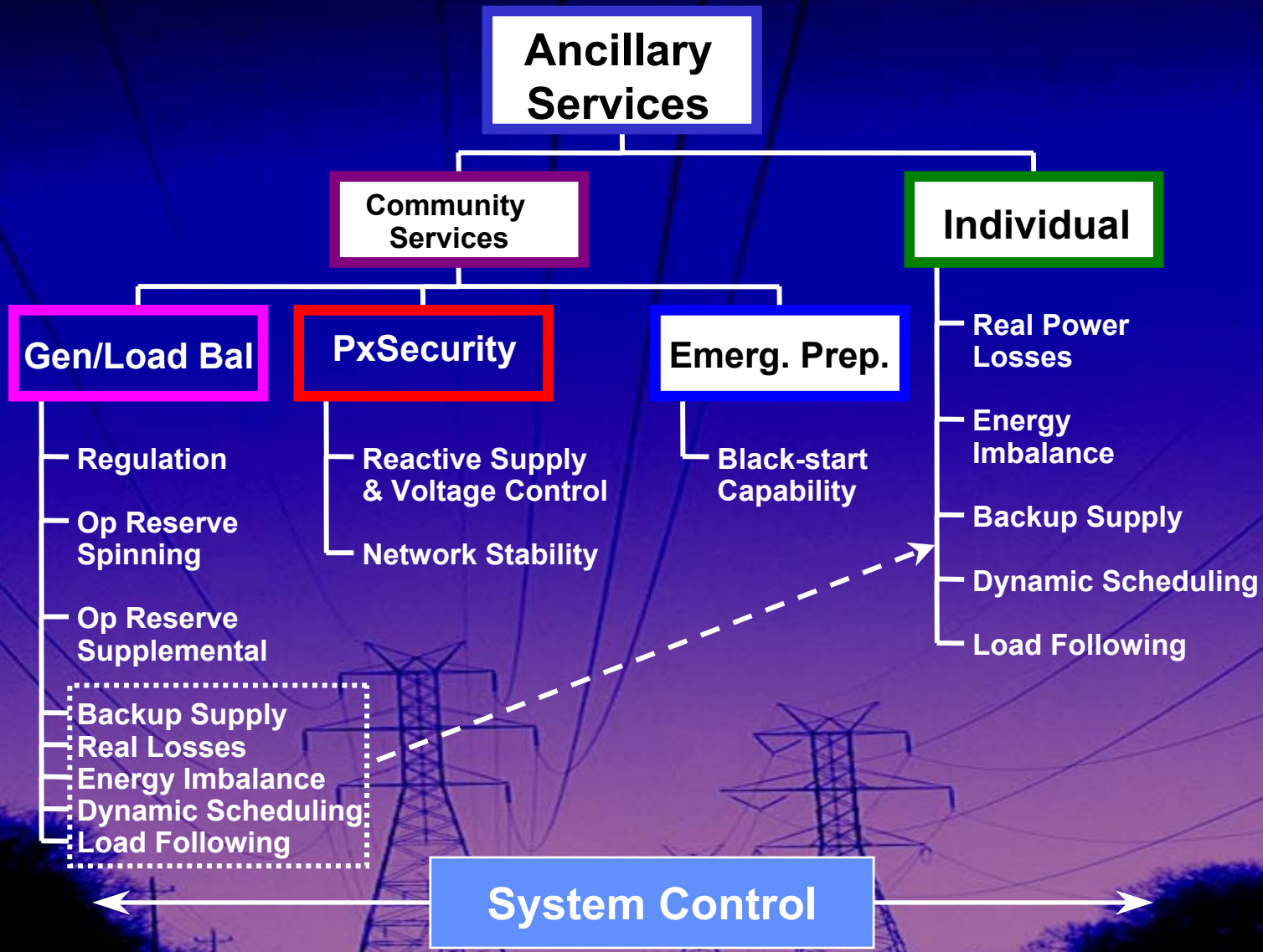
- Capacity
- Energy
- Ancillary Services
  - Spinning Reserve
  - Non Spinning Reserve
  - Black Start
- Management of System
- Load Factor

VALUES

- Dispatchable
- Remotely controllable
- Infinite Increments
- Selectable Locations
- Supply & Demand Side
- Resources

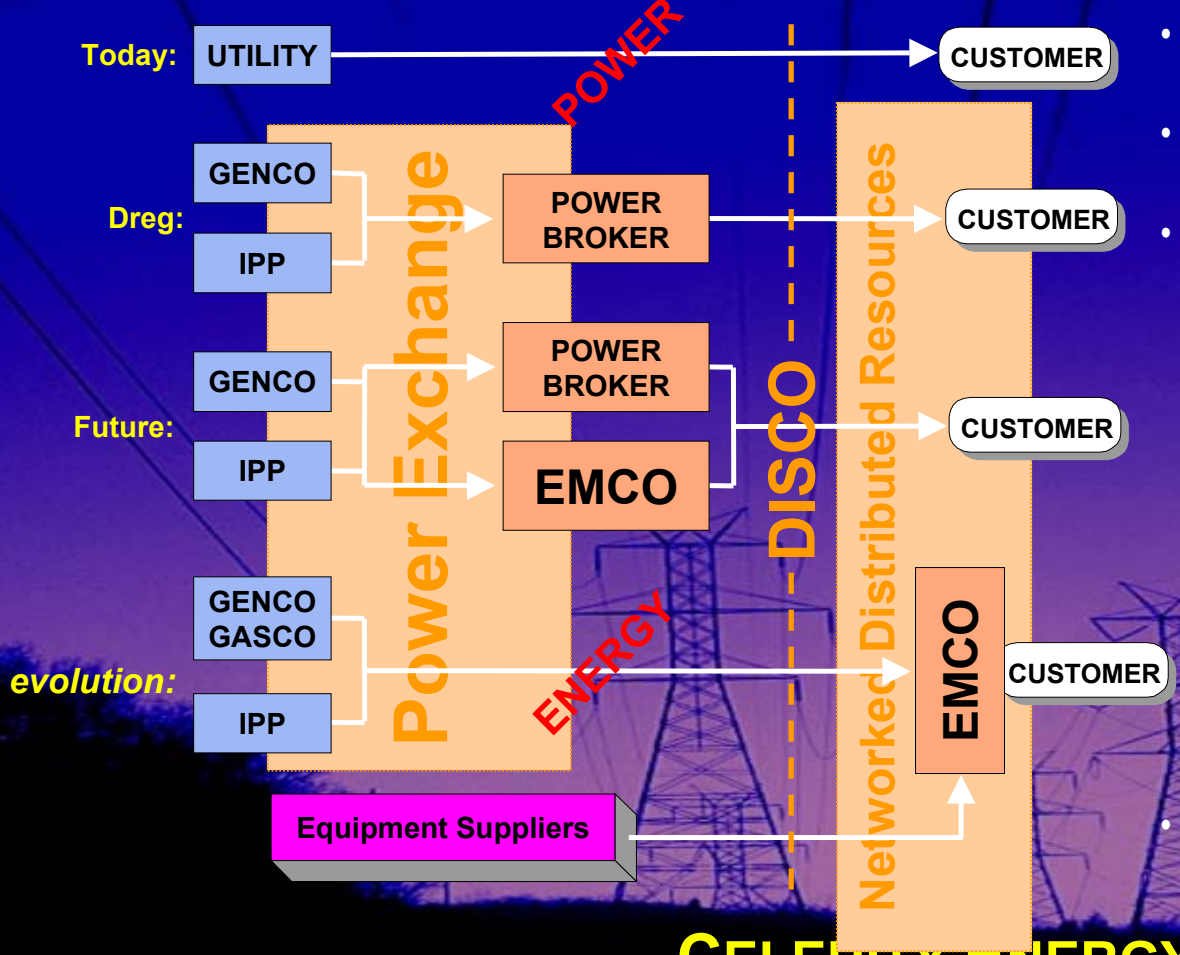
… helps to optimize the grid & supplement local supply or delivery needs

DG has a better ROI from *capacity* than *energy*



How will Deregulation effect the *ENERGY* industry?

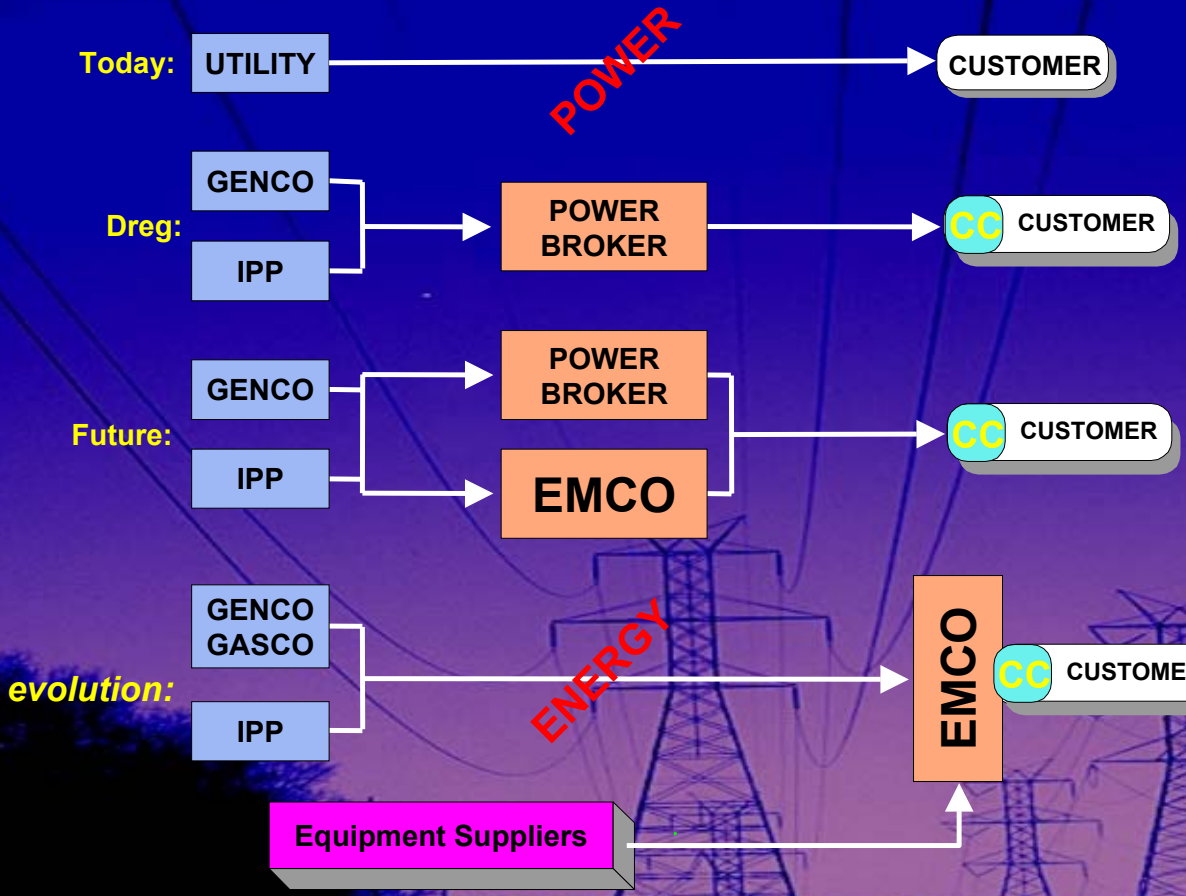
...the emerging EMCO



- **UTILITY** sells power to customers
- **GENCO** sells bulk power to PX
- **DR** *emerges* serving supply side
  - capacity - bulk power - ancillary services
- **DR** *expands* towards customer's side
  - QOS - risk – DSM – efficiency - consumption
- **EMCO - E**nergy **M**anagement **Co**mpany
  - differentiates from Power Broker
    - value added energy **"SERVICES"**
    - marginal value of energy vs. commodity cost
  - capture DR locational values of customer
  - manages customer's energy risk
    - QOS = productivity & yield
    - energy bulk commodity cost
  - manage customer's interaction with **DISCO**
    - real vs. apparent power
    - harmonics
    - DSM
    - information
    - Distributed Resources
- **EMCO**'s will manage all energy sourcing, operation, quality and many of the Customer's energy capital equipment purchases

Deregulation, Distributed Generation and ...

...Command & Control



- **Mass Customization -** giving each customer the unique services he wants in a competitive market will be the significant differentiator in the Deregulated market, not the lowest cost per kW
- **Communication** and information flow will be the enabler that makes Mass *ENERGY* Customization possible.
- **Questions**
  - Will high bandwidth become so low cost that anything can be wired directly to it or will low bandwidth require aggregation before connecting to high?
  - Will a DISCO's *right of way* have value as the aggregator of low bandwidth or will wireless, Telco, broadband prevail?
- **Command & Control**
  - the logical aggregator of energy information
  - can also be used for status monitoring and alarm and as a push channel for community info like the French MiniTel system
  - It is the logical manager for Distributed Resources, as well as all AMR.
- **A new business opportunity for EMCOs**

Technology Convergence Enhances Outsourcing

Sophistication of Distributed Intelligent Devices

the INTERNET cost of info drops

Moore's Law (Information capability doubles every 18 months

Changing Customer Behavior (Outsourcing)

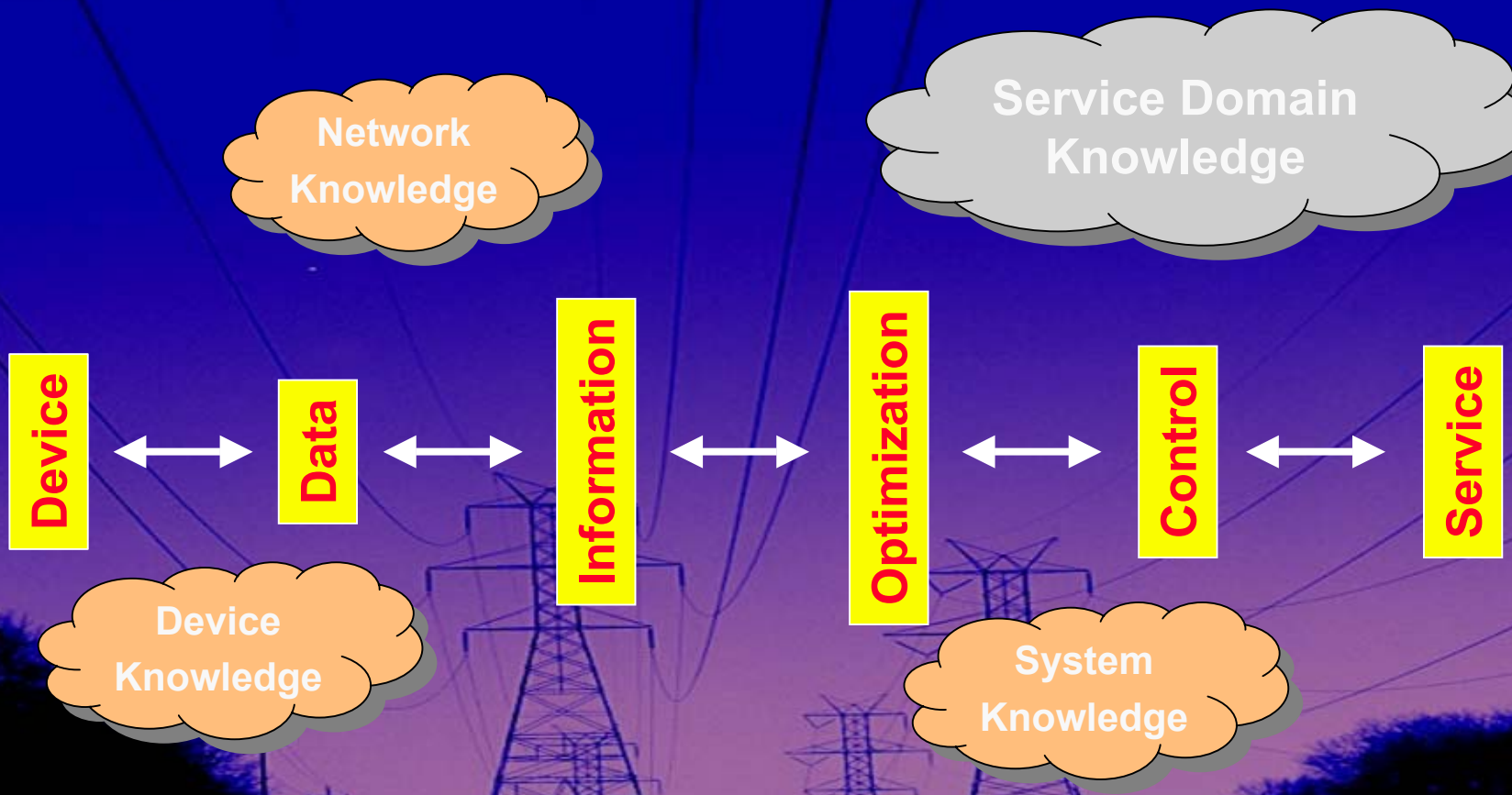
New Economics marginal not average Cost - Value

- Outsourcing of energy management is driven by Customer competitiveness and operational effectiveness
- Resulting in the customer demanding:
  - Result-based energy solutions
  - Collection and translation of real time data to business metrics
  - Bundled Services (BRAND) - not discrete services or technology

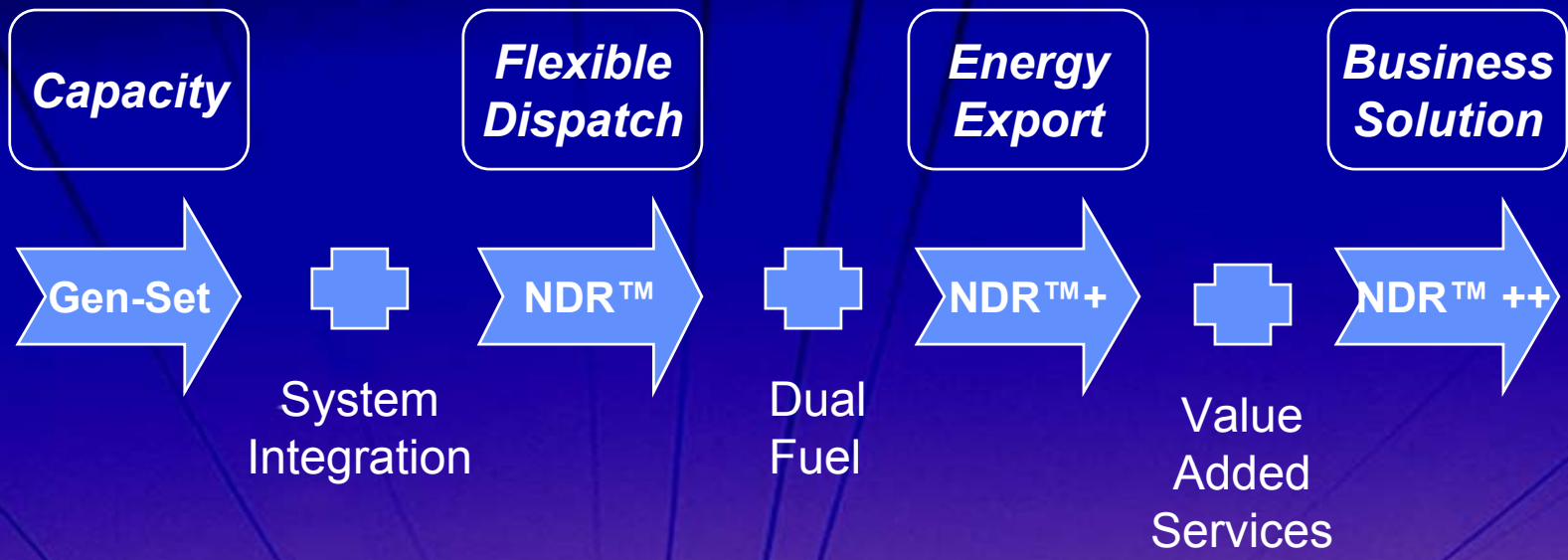
Network Distributed Resources (e.g.Gen Sets, HVAC, DSM)

Information Flow....

...the essential ingredient for creation of Added Value



Networked Distributed Resources™



…this path continually grows with the addition of new Technologies

and

new Services for both the Utility and end customer

Process & Permitting

- Select Area of Market Opportunity
- Screen and Initial set of End-Use Customers
- Meet with Local Permitting Agencies
- File for EWG with FERC
- Negotiate Contracts with Energy Suppliers & "Participants"
- Recruit Generation and Demand-side Assets
- Complete Final Designs; Permitting; Procure Hardware & Software; Implement Installation & Testing
- Operating, Maintenance & Reporting

U.S. Diesel & Gas Gen-sets 2000

	Diesel - MWe							Gas or Gasoline - MWe				
kWe Size	375 - 500	501 - 750	751 - 1000	1001 - 1300	1301 - 1800	1801 - 2235	Total	375 - 1000	1001 - 1800	1800 - 2235	Total	Sum
TX	2981	3086	1417	4482	2380	149	14495	983	153	103	1239	15734
CA	1624	1602	735	2329	1229	72	7591	507	76	53	636	8227
IL	764	747	343	1093	573	29	3549	232	31	20	283	2832
NY	688	707	322	1029	544	27	3317	220	27	18	265	3582
All Others	11717	11796	5345	17298	8980	402	55538	3564	317	259	4140	60678
Total	17774	17938	8162	26231	13706	679	84490	5506	604	453	6563	91053

Environmental Considerations

Generation Sources

- Internal Combustion Engines
  - Diesel
  - Gas
  - Dual Fuel
  - Fuel Alternatives – Biodiesel
- Hybrid – ICE and Renewables
  - Solar
  - Wind
  - Hydro

Mitigation Alternatives

- Diesel – 8g/bhp-hr NOx; 0.2 particulate; 1.0 CO
- NG – 2.5 g/bhp-hr NOx; .06 particulate; 1.0 CO
- Dual fuel (90% NG/ 10% diesel) – 2.6 g/bhp-hr NOx; .08 particulate; 1.0 CO
- Back-end Solutions (filters, catalytic converters, etc.) – 1.2 g/bhp-hr NOx; .05 particulate; 1.0 CO

If you can't measure it ... it's tough to do a deal

- New metrics are needed to quantify the locational values of energy...

  A set of goals needs to be created by energy user for the technologists that are going to design and implement the the information command and control system that will be enabled distributed generation. The goals need to address:

  1. To define a metric to measure and quantify the costs/values that capacity/energy contributes to the cost of goods/services or the quality of life. Cost/values would include such items as ecology, opportunity, risk, asset utilization and depletion as well as the current energy direct cost/value set.
  2. Identify methods for quantifying that cost/value that is more accurate than the current commodity service entrance tariff method.
  3. Identify value components that should be market based (commodity and information) and methods to add/delete/modify components over time.
  4. Define regional/national market structure (reference market designs) and the key elements necessary. Elements include:
     - methods for market making of components identified
     - information flow and control flow models
     - methods for system "resource planning/modeling" that accommodate the metric

Conclusions

- **It's still all about the Business Proposition**, However if the playing field is "relatively" level then there are significant applications of distributed energy resources that provide value to energy suppliers and energy users, while meeting site and environmental permitting requirements.